

NIST TIME AND FREQUENCY BULLETIN
NIST IR 6636-02

NO. 566 FEBRUARY 2005

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1. GENERAL BACKGROUND INFORMATION

ACRONYMS AND ABBREVIATIONS USED IN THIS BULLETIN

ACTS	- Automated Computer Time Service	
BIPM	- Bureau International des Poids et Mesures	
Cs	- Cesium standard	
GPS	- Global Positioning System	
IERS	- International Earth Rotation Service	
LORAN	- Long Range Navigation	
MC	- Master Clock	
MJD	- Modified Julian Date	
NVLAP	- National Voluntary Laboratory Accreditation Program	
NIST	- National Institute of Standards and Technology	
NOAA	- National Oceanic and Atmospheric Administration	ns - nanosecond
SI	- International System of Units	μs - microsecond
TA	- Atomic Time	ms - millisecond
TAI	- International Atomic Time	s - second
USNO	- United States Naval Observatory	min - minute
UTC	- Coordinated Universal Time	

2. TIME SCALE INFORMATION

The values listed below are based on data from the IERS, the USNO, and NIST. The UTC(USNO,MC) - UTC(NIST) values are averaged measurements from all available common-view GPS satellites (see bibliography on page 5). **UTC - UTC(NIST) data are on page 3.**

0000 HOURS COORDINATED UNIVERSAL TIME			
JAN 2005	MJD	UT1-UTC(NIST) (±5 ms)	UTC(USNO,MC) - UTC(NIST) (±20 ns)
6	53376	-507 ms	11 ns
13	53383	-510 ms	13 ns
20	53390	-517 ms	6 ns
27	53397	-518 ms	3 ns

The master clock pulses used by the WWV, WWVH, and WWVB time-code transmissions are referenced to the UTC(NIST) time scale. Occasionally, 1 s is added to the UTC time scale. This second is called a leap second. Its purpose is to keep the UTC time scale within ±0.9 s of the UT1 astronomical time scale, which changes slightly due to variations in the Earth's rotation.

NOTE: No leap second will be added at the end of June 2005.

Positive leap seconds, beginning at 23 h 59 min 60 s UTC and ending at 0 h 0 min 0 s UTC, were inserted in the UTC timescale on 30 June 1972, 1981-1983, 1985, 1992, 1993, 1994, and 1997, and on 31 December 1972-1979, 1987, 1989, 1990, 1995, and 1998.

The use of leap seconds ensures that UT1 - UTC will always be held within ±0.9 s. The current value of UT1 - UTC is called the DUT1 correction. DUT1 corrections are broadcast by WWV, WWVH, WWVB, and ACTS and are printed below. These corrections may be added to received UTC time signals in order to obtain UT1.

DUT1 = UT1 - UTC =

-0.1 s beginning 0000 UTC 04 October 2001
-0.2 s beginning 0000 UTC 14 February 2002
-0.3 s beginning 0000 UTC 24 October 2002
-0.4 s beginning 0000 UTC 03 April 2003
-0.5 s beginning 0000 UTC 29 April 2004

The difference between UTC(NIST) from UTC has been within +/-100 ns since July 6, 1994. The table below shows values of UTC - UTC(NIST) as supplied by the BIPM in their Circular T publication for the most recent 310-day period in which data are available. Data are given at ten-day intervals. Five-day interval data are available in Circular T.

0000 Hours Coordinated Universal Time

DATE	MJD	UTC-UTC(NIST) ns
Dec. 30,2004	5338	3.5
Dec. 20,2004	53359	-2
Dec. 10,2004	5338	5.1
Nov30,2004	53339	-7
Nov20,2004	53329	2.5
Nov10,2004	53319	2.6
Oct. 31,2004	53309	3.4
Oct. 21,2004	5329	1.4
Oct. 11,2004	5328	3.7
Oct. 01,2004	5329	3.5
Sep. 21,2004	5328	-1
Sep. 11,2004	53259	-7
Sep. 01,2004	5328	2.5
Aug. 22,2004	53239	0.9
Aug. 12,2004	53229	-2.5
Aug. 02,2004	53219	-2.5
Jul. 23,2004	53209	-40
Jul. 13,2004	5319	-60
Jul. 03,2004	5318	-5.3
Jun. 23,2004	5319	-61
Jun. 13,2004	5318	-5.2
Jun. 03,2004	53159	0.2
May 24,2004	5318	5.4
May 14,2004	53139	9
May 04,2004	53129	10.5
Apr. 24,2004	53119	75
Apr. 14,2004	53109	60
Apr. 04,2004	5309	57
Mar. 25,2004	5308	63
Mar. 15,2004	5308	-1
Mar. 05,2004	5308	3.2

3. PHASE DEVIATIONS FOR WWVB AND LORAN-C

WWVB - The values shown for WWVB are the time differences between the time markers of the UTC(NIST) time scale and the first positive-going zero voltage crossover measured at the transmitting antenna. The uncertainty of the individual measurements is $\pm 0.5 \mu\text{s}$. The values listed are for 1300 UTC.

LORAN-C - The values shown for Loran-C represent the daily accumulated phase shift. The phase shift is measured by comparing the output of a Loran receiver to the UTC(NIST) time scale for a period of 24 h. If data were not recorded on a particular day, the symbol (-) is printed. The stations monitored are Baudette, ND (8970-Y) and Fallon, NV (9940). The monitoring is done from the NIST laboratories in Boulder, Colorado.

Note: The values shown for Loran-C are in nanoseconds.

DATE	MJD	ANTENNA PHASE (μs)	<u>UTC(NIST)-WWVB</u> <u>(60 kHz)</u>		UTC(NIST) - LORAN PHASE (ns)
			LORAN-C (BAUDETTE) (8970)	LORAN-C (FALLON) (9940)	
01/01/04	53371	5.73	+101	+107	
01/02/04	53372	5.73	-108	-246	
01/03/04	53373	5.74	+132	+559	
01/04/04	53374	5.74	+93	-144	
01/05/04	53375	5.75	+237	+195	
01/06/04	53376	5.74	+32	+51	
01/07/04	53377	5.75	+32	+216	
01/08/04	53378	5.75	-110	-355	
01/09/04	53379	5.76	-73	+121	
01/10/04	53380	5.76	-26	-168	
01/11/04	53381	5.76	-106	-212	
01/12/05	53382	5.76	-127	+343	
01/13/05	53383	5.77	+5	-172	
01/14/05	53384	5.76	+466	-56	
01/15/05	53385	5.76	+136	-429	
01/16/05	53386	5.76	-295	+401	
01/17/05	53387	5.77	+36	-148	
01/18/05	53388	5.78	-392	+142	
01/19/05	53389	5.78	-34	-118	
01/20/05	53390	5.79	+33	-259	
01/21/05	53391	5.78	+50	-257	
01/22/05	53392	5.79	-380	+93	
01/23/05	53393	5.79	-125	+358	
01/24/05	53394	5.79	-283	+102	
01/25/05	53395	5.79	+66	-196	
01/26/05	53396	5.72	+43	+502	
01/27/05	53397	5.73	+49	-79	
01/28/05	53398	5.71	-63	+215	
01/29/05	53399	5.70	-76	+282	
01/30/05	53400	5.70	+89	-308	
01/31/05	53401	5.70	-556	+515	

4. BROADCAST OUTAGES OVER FIVE MINUTES AND WWVB PHASE PERTURBATIONS

OUTAGES OF 5 MINUTES OR MORE						PHASE PERTURBATIONS 2 ms				
Station	JAN 2005	MJD	Began UTC	Ended UTC	Freq.		JAN 2005	MJD	Began UTC	End UTC
WWVB	1/26/05	53396	1803	1829	60 kHz					
WWW										
WWWH										

5. NOTES ON NIST TIME SCALES AND PRIMARY STANDARDS

Primary frequency standards developed and operated by NIST are used to provide accuracy (rate) input to the BIPM. NIST-7 was the U.S. primary standard from 1994 to 1999, when it was replaced by NIST-F1, a cold-atom cesium fountain frequency standard. The uncertainty of NIST-F1 is currently about 1 part in 10^{15} .

The AT1 scale is run in real-time by use of data from an ensemble of cesium standards and hydrogen masers. It is a free-running scale whose frequency is maintained as nearly constant as possible by choosing the optimum weight for each clock that contributes to the computation.

UTC(NIST) is generated as an offset from our real-time scale AT1. It is steered in frequency towards UTC by use of data published by the BIPM in its Circular T. Changes in the steering frequency will be made, if necessary, at 0000 UTC on the first day of the month, and occasionally at mid-month. A change in frequency is limited to no more than ± 2 ns/day. The frequency of UTC(NIST) is kept as stable as possible at other times.

UTC is generated at the BIPM using a post-processed time-scale algorithm and is not available in real-time. The parameters that we use to generate UTC(NIST) in real-time are therefore based on an extrapolation of UTC from the most recent available data.

6. BIBLIOGRAPHY

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Table 7.1 lists parameters that are used to define UTC(NIST) with respect to our real-time scale AT1. To find the value of UTC(NIST) - AT1 at any time T (expressed as a Modified Julian Day, including a fraction if needed), the appropriate equation to use is the one for which the desired T is greater than or equal to the entry in the T_o column and less than the entry in the last column. The values of x_{ls} , x, and y for that month are then used in the equation below to find the desired value. The parameters x and y represent the offset in time and in frequency, respectively, between UTC(NIST) and AT1; the parameter x_{ls} is the number of leap seconds applied to both UTC(NIST) and UTC as specified by the IERS. Leap seconds are not applied to AT1.

Table 7.1
UTC(NIST) - AT1 = $x_{ls} + x + y(T - T_o)$

Month	x_{ls} (s)	x (ns)	y (ns/d)	T_o (MJD)	Valid until 0000 on: (MJD)
Mar 05	-32	-275403.5	-39.0*	53430	53461
Feb 05	-32	-274311.15	-39.0	53402	53430*
Jan 05	-32	-273102.15	-39.0	53371	53402
Dec 04	-32	-272712.15	-39.0	53361	53371
Dec 04	-32	-271891.05	-39.1	53340	53361†
Nov 04	-32	-270718.05	-39.1	53310	53340
Oct 04	-32	-269505.95	-39.1	53279	53310
Sep 04	-32	-268723.95	-39.1	53259	53279
Sep 04	-32	-268330.95	-39.3	53249	53259†
Aug 04	-32	-267898.65	-39.3	53238	53249
Aug 04	-32	-267110.65	-39.4	53218	53238†
Jul 04	-32	-266716.65	-39.4	53208	53218
Jul 04	-32	-265892.4	-39.25	53187	53208†
Jun 04	-32	-265342.9	-39.25	53173	53187
Jun 04	-32	-264722.9	-38.75	53157	53173†
May 04	-32	-264064.15	-38.75	53140	53157
May 04	-32	-263514.65	-39.25	53126	53140†
Apr 04	-32	-263004.4	-39.25	53113	53126
Apr 04	-32	-262334.6	-39.4	53096	53113†
Mar 04	-32	-261783.0	-39.4	53082	53096
Mar 04	-32	-261110.65	-39.55	53065	53082†
Feb 04	-32	-259963.7	-39.55	53036	53065

† Ratumihb
†† Ratumihb
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7 SPECIAL ANNOUNCEMENTS

